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Project Plan for the Baseline Measurement of Checkpoint Effectiveness and Efficiency

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16. Abstract - A project plan for obtaining baseline measurements of operational effectiveness and efficiency of the Northwestern checkpoint at Detroit Wayne Metropolitan Airport is described. The project will consist of carefully structured observations of checkpoint tasks under operational conditions. The baseline report will provide information that can be used to evaluate changes in checkpoint design.		
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CONTENTS

Page

1. INTRODUCTION 1
   1.1 Background 1
   1.2 Problem Statement 1
2. PROJECT GOALS 1
3. MAJOR PROGRAM ACTIVITIES 1
   3.1 Project Management 1
   3.2 Technical Approach 2
      3.2.1 Phase 1 - Test and Evaluation Plan 2
      3.2.2 Phase 2 – Pilot Test 4
      3.2.3 Phase 3 – Measurement 4
      3.2.4 Final Report 4
4. SCHEDULE, DELIVERABLES, AND RESOURCES 5
   4.1 Schedule 5
   4.2 Deliverables 6
   4.3 Resources 6
5. REFERENCES 7

Illustrations

Figures **Page**

Figure 1 Work Breakdown Structure 5

Tables

Table 1. Deliverables 6
Table 2. Resources, Hours, and Personnel 6

LIST OF ACRONYMS

DTW	Detroit Wayne Metropolitan Airport
MOE	Measure of Effectiveness
MOP	Measure of Performance
QA	Quality Assurance
TEP	Test and Evaluation Plan

1. INTRODUCTION

1.1 Background

The effectiveness of the national civil aviation security system is highly dependent upon people, especially those employed as checkpoint screeners. Therefore, the FAA is very interested in enhancing screener training, performance, and further improving their readiness for the job.

The Aviation Security Improvement Act, Public Law 101-604, mandates the Federal Aviation Administration (FAA) to enhance and improve X-ray baggage screener selection, training, and performance. The Aviation Security Human Factors Program (AAR-510) of the Aviation Security Research and Development Division, is the FAA unit tasked with this responsibility.

1.2 Problem Statement

Passenger and carry-on baggage throughput at Detroit Wayne Metropolitan Airport (DTW) is considered slow, causing considerable lines at the checkpoint. By performing a human factors evaluation of the checkpoint, including screener performance, problems can be identified and improvements in throughput and security can be accomplished. This includes redesigning the checkpoint, deploying advanced technological systems, and improving screener performance.

2. PROJECT GOALS

The objective of this project is to collect, analyze, and report baseline data on passenger flow restrictions and threat detection. These data can then be used to evaluate future states of the checkpoint and screener performance.

3. MAJOR PROGRAM ACTIVITIES

3.1 Project Management

Quality Assurance (QA) is the overall process of evaluations, inspections, and audits conducted during the project's development process and its products to ensure that: (1) the process and products conform to their established plans and standards; (2) the final product(s) completely and accurately implement(s) the system's functional, performance, and operational requirements; and (3) the system is built to the highest quality attributes possible (reliability, maintainability, supportability, robustness, extensibility, etc.). The QA is conducted internally by the contractor's QA organization, managerially independent from the performing organization. The QA will include overall project-level QA consisting of formal and informal reviews, inspections, walkthroughs, measurements, and quality audits.

The QA activities envisioned for this project include the following:

1. Formal/Informal Reviews—formal and informal reviews will include the following:

    - Formal reviews will be conducted at the conclusion of each phase of the project and completion of a major task or step in a phase. They are the decision milestones for internal or government approval to proceed from one development phase to the next.
    - Informal reviews will be conducted by QA personnel between formal reviews to evaluate progress towards phase completion and/or assess readiness for the formal reviews.

2. Evaluation/Inspections—evaluation and inspections will be conducted periodically by QA to assess conformance to the project plan, engineering and software development processes, and contract requirements.

3. Quality Assurance Reporting—monthly status reports will include QA activities performed for the reporting period; results of these activities; problems identified and corrected or action items assigned; status of previous action items; and plans for the next reporting period.

4. Final Delivery Certification—functional and physical configuration audits will ensure that the product meets its original requirements and that all changes made through the development process have been properly integrated.

3.2 Technical Approach

This effort will focus on two main problem areas: passenger flow and threat detection. This section identifies the four phases of the project and the critical issues associated with the problem areas.

3.2.1 Phase 1 - Test and Evaluation Plan

Before drafting a Test and Evaluation Plan (TEP), two human factors engineers will travel to DTW to speak with the Federal Security Manager and other security personnel. The purpose of the trip will be to acquire information regarding test variables (i.e., what information can be captured) and data collection (i.e., the use, control, and location of video cameras, archived tapes, and incident reports). In addition, they will elicit information regarding perceived problems, staffing requirements, and security procedures. Finally, they will visit the checkpoint to get a better sense of its layout and equipment.

Following the visit to DTW, a TEP based in part on information gathered during the trip will be constructed. The TEP will focus on four critical issues: flow, threat detection, training, and screener communication. It will include Measures of Performance (MOPs) and Measures of Effectiveness (MOEs) required to accurately baseline the current checkpoint operation. Furthermore, the TEP will outline an approach to evaluating the MOPs and MOEs and collecting, reducing, and analyzing the data.

<u>Task-Based MOPs and MOEs</u>

Checkpoint operations can be subdivided into a set of discreet tasks performed by screeners and supervisors. Each screener task serves the overall mission of effectively (deterring and detecting threats) and efficiently (operating with minimum effects on throughput) processing passengers and their baggage. Before constructing task-based MOPs and MOEs, a review will be made of previous analyses of checkpoint operations and the knowledge, skills, and abilities involved in performing specific checkpoint tasks (Fobes & Neiderman, 1997; Monichetti, Fobes, & Neiderman, in press). Major checkpoint tasks to be included are walk-through and hand-held magnetometer, pat-down, hand search, X-ray, trace detector, exit land, and supervision. MOPs and MOEs will be constructed around all of the essential checkpoint tasks. They will be designed to answer questions like

- Are effective procedures followed?
- Are the security staff adequately trained to follow effective procedures?
- Do the security staff communicate effectively in performing tasks?
- How quickly are tasks accomplished?
- Are staffing levels and staff knowledge adequate to accomplish tasks quickly?

Potential MOEs are provided below.

Passenger Flow Baseline
- Throughput (passengers and bags)
  - Number of people processed using the X-ray machine
  - Average amount of time to process using the X-ray machine
  - Number of people processed using the front magnetometer
  - Average amount of time to process using the front magnetometer
  - Number of people processed using the back magnetometer
  - Average amount of time to process using the back magnetometer
  - Number of people processed using the hand wand
  - Average amount of time to process using the hand wand
  - Number of people processed using the Electronic Detection System (EDS)
  - Average amount of time to process using the EDS
- Staffing numbers (screeners, supervisors, duty managers)

Threat Detection Baseline
- TIP performance (P_d, P_m, P_{fa}, $\underline{c}$, d')
- CBT performance (initial and final Unit 7 and 8 scores)
- Training (initial, on-the-job, and recurrent)
- Previous threat detection studies by FAA testing organization(s)
- DTW incident reports
- Measures of compliance with effective threat detection procedures

<u>Integrating Tasks Into a Checkpoint Model</u>

The screening tasks are interrelated with the outcome of one task dictating performance of another. Other MOPs and MOEs will be constructed using a checkpoint model that specifies the relationships between tasks. These include the probabilities of moving between one task and another, as well as the integration of task performance times into global measures like the average amount of time to pass through the checkpoint. Checkpoint operations and measures, considered as a whole, are likely to be influenced by variables such as passenger volume and staffing levels. The MOPs and MOEs will be constructed to specify these global variables and their influence upon checkpoint operations.

With a careful choice of measures, a plan for a baseline description of the checkpoint, which produces valid and useful information, will be constructed. This will include descriptions of staffing levels, traffic volume, and time and probability elements for each screener task (i.e., X-ray, magnetometer, hand wand, bag search, trace, and exit lane) as well as supervisory positions. Effectiveness and efficiency measures for each task will be described. Threat Image Projection performance and the frequencies of deviations from procedures will be part of the baseline description of effectiveness.

3.2.2 Phase 2 – Pilot Test

After developing the TEP, a pilot study will be conducted to determine if one can accurately collect the necessary data. Any deficiencies in data collection procedures will be identified and any newly identified variables incorporated into the actual test. Any measures of effectiveness or efficiency associated with a particular position that cannot be accurately recorded, will be brought to the attention of AAR-510. These variables will then be revised or eliminated. Data received from the pilot study will be used to create a database from which data reduction tools can be developed. This will enable the data to be more quickly analyzed from the actual test.

3.2.3 Phase 3 – Measurement

The results of the pilot test will be the basis for the actual collection of MOP data. At this point, useful and realistic MOEs and MOPs will be identified and tested, as will the effort required in the data collection process.

3.2.4 Final Report

Upon completion of Phase 3, a final report will be composed describing the method, results, and lessons learned from the baseline study. To the extent possible, it will describe the effectiveness and efficiency for each screener task, as well as diagram the checkpoint and passenger flow through it. Finally, it will provide possible human factors solutions to alleviate problems associated with the issues of slow flow, threat detection, training deficiencies, and screener communication. Information from the final report can be given to subject matter experts so that a checkpoint model can be developed. This will allow what-if scenarios and capacity variations to be simulated.

4. SCHEDULE, DELIVERABLES, AND RESOURCES

4.1 Schedule

Figure 1 depicts the work breakdown structure of this project.

ID	Task Name	WBS
1	**HF008- Checkpoint Design Project**	1
2	**Project Planning**	1.1
3	**status review**	1.1.1
11	Ongoing Planning	1.1.2
12	Project Plan	1.1.3
13	**Test and Evaluation Plan**	1.2
14	Inspect site	1.2.1
15	Construct Measures	1.2.2
16	Write Draft	1.2.3
17	**OperationalTesting**	1.3
18	Data collection materials	1.3.1
19	Data collection strategies	1.3.2
20	Pilot testing	1.3.3
21	Analyze pilot	1.3.4
22	Revise plan and procedures	1.3.5
23	Operationa Test site visit 1	1.3.6
24	Data Analysis 1	1.3.7
25	Operational Test Site visit 2	1.3.8
26	Complete Data Analysis	1.3.9
27	**Final Report**	1.4
28	Review Findings	1.4.1
29	Prepare Data Presentation Forr	1.4.2
30	Prepare Draft Report	1.4.3
31	Revise Report	1.4.4

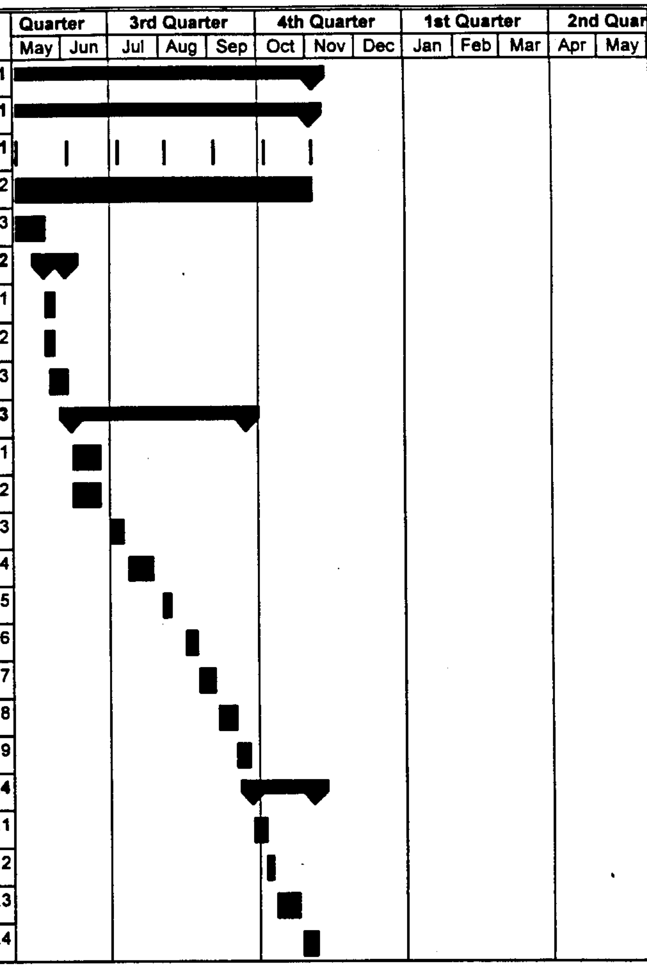

Figure 1. Work Breakdown Structure

4.2 Deliverables

Table 1 contains all project deliverables and their due dates.

Table 1. Deliverables

Deliverables	Due Dates
Monthly Status Reports	Monthly beginning June 1999
Trip Reports	Within 5 days of return
Project Plan	May 11, 1999
Test and Evaluation Plan	May 27, 1999
Final Report	September 24, 1999

4.3 Resources

Table 2 contains a list of project resources, hours, and key personnel required for this task.

Table 2. Resources, Hours, and Personnel

Resources	Hours	Personnel
Program Manager	104	Mr. Bischoff and Dr. Lyons
Senior HF Engineers	750	Dr. Maguire and Mr. Snyder
HF Engineers	870	Mr. Winters and Mr. Newman
Documentation Specialist	120	Ms. Militello
Clerk	30	Ms. Deckard

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